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Revision of the genus *Philoplitis* Nixon (Hymenoptera, Braconidae, Microgastrinae)

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Abstract

The genus *Philoplitis* Nixon is revised. Three new species, *P. masneri* Fernández-Triana & Goulet, **sp. n.**, *P. punctatus* Fernández-Triana & Goulet, **sp. n.**, and *P. striatus* Fernández-Triana & Goulet, **sp. n.** are described, and a key is provided to the World species. The genus, previously known only from the Oriental region, is here recorded from the Afrotropical region. Evidence suggests that its included species are broadly found in rainforest areas of the Old World tropics. Clarification and suggestions about some character states previously used with *Philoplitis* within the context of Microgastrinae phylogenetic studies are also provided.

Keywords

Philoplitis, Microgastrinae, Afrotropical, Oriental

Introduction

Species of *Philoplitis* Nixon are among the most distinctive microgastrine braconids because of the enormous scutellum, which is conically prolonged posteriorly above the propodeum (Mason 1981). The phylogenetic position of the genus within Microgastrinae is not well established. However, earlier works consider it related to *Alloplitis*

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(Mason 1981; Walker et al. 1990), whereas recent papers hypothesize a closer relationship with *Microplitis, Snellenius*, and/or *Protomicroplitis* (Whitfield et al. 2002; You et al. 2002). Host records are unknown.

Philoplitis was described as a monobasic genus by Nixon (1965) based on specimens from the Philippines, and the same species (*P. coniferens* Nixon) was later found in southeastern China (He 1983; You et al. 1990). Mason (1981) mentioned an additional undescribed species from southern India. Ahmad et al. (2005) described *Philoplitis adustipalpus* from northern India but did not comment if the new species was related to that of Mason's paper. Here we revise the genus, record it for the first time from Africa, and describe three new species.

Methods

We studied collections known to contain *Philoplitis* except for the specimens representing the Chinese and Northern India records (He 1983; You et al. 1990; Ahmad et al., 2005). This included: (1) part of the type series of *P. coniferens* Nixon (the holotype and two paratypes), as well as three unidentified specimens from Sri Lanka, all of which are in the National Museum of Natural History (NMNH), and (2) the undescribed Indian specimen as well as one unidentified specimen from Kenya, in the Canadian National Collection (CNC).

Morphological terms and wing venation designations follow the works of Goulet and Huber (1993) and Sharkey and Wharton (1997). We calculated some vein ratios in the forewing (Fig. 2). The term "(*r-2M*)" refers to the distance between *2M* and the point of the stigma where vein *r* arises. The height of the second submarginal cell was measured from *2M* to the point where *r* meets both *2RS* and *3RSa*. For all ratios we measured the distance from the closest edge of one vein to the closest edge of the other. Length of mesoscutum and scutellum (excluding the scutellar scrobe, i.e. only the scutellar disc) were measured dorsally. Whenever several specimens of a species were available for study, the first number provided is the mean, with the range in parentheses.

Results

***Philoplitis* Nixon, 1965**: 267.

Diagnosis. Adults of *Philoplitis* (Fig. 1) are distinguished by the following characteristics: palpi dark, with apical segments of maxillary palps paler; pronotum laterally with broad, crenulate dorsal groove and narrow ventral one; propleuron with lobe above coxae extending up and back over lower corner of pronotum; mesoscutum usually with carinate lateral margin above tegulae; scutellum coarsely punctate and greatly prolonged posteriorly over propodeum, being about as long as mesoscutum when measured from anterior margin of scutellar scrobe; metanotum punctate and withdrawn

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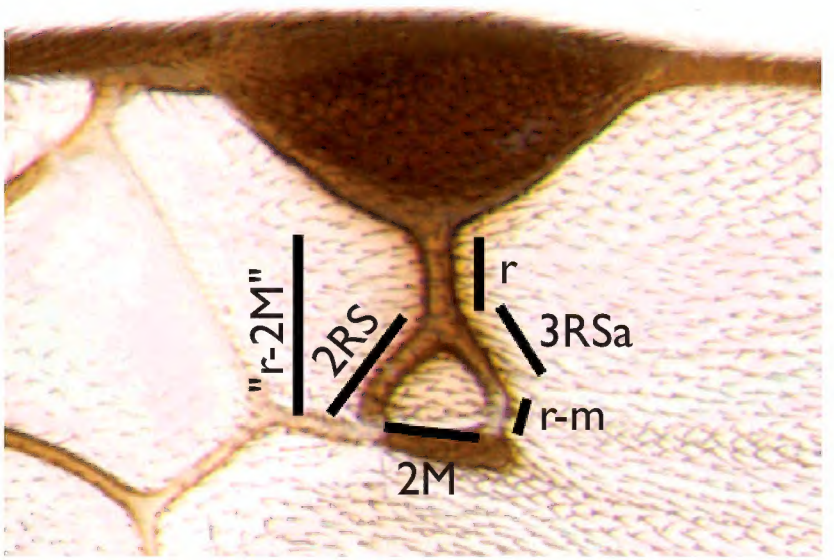

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Figures 1–2. 1 Habitus of *Philoplitis masneri* **2** Detail of the forewing of *Philoplitis striatus* showing the vein measurements.

from scutellum exposing scutellar phragma, with anterior margin bearing long, cylindrical, apically setose process laterally; propodeum strongly rugose and bearing complete median longitudinal carina; mediotergite 1 rectangular and mediotergite 2 with

truncate, smooth or sculptured pyramidal area; metatibiae with inner spur extending slightly beyond the middle of first tarsomere.

Key to species of *Philoplitis*

1 Metatibial spurs dark brown; scutellar disc (Fig. 5) relatively short (length/width 0.92), its length 0.77× that of mesoscutum; scutellum in lateral view with apex pointing dorsally; mesoscutum with coarse punctures medially and along anterior and lateral margins (last one above tegulae) (Fig. 8 and 11); forewing with length of vein *r* 1.00x of *3RSa*, 1.00x *r-m* and 0.50× *2RS* (Thailand) ..... ***Philoplitis punctatus* sp. n.**

– Metatibial spurs white, yellow or yellowish-brown but not dark brown; scutellar disc (Fig. 3, 4 and 6) relatively long (length/width > 1.00), its length more than 0.83× that of mesoscutum, usually close to same size as mesoscutum; scutellum in lateral view with apex truncate, pointing ventrally or posteriorly; mesoscutum without coarse punctures medially and along anterior and lateral margins, sometimes with impressed surface posterolaterally; forewing with length of vein *r* > 1.33× *3RSa*, > 1.80× *r-m* and > 0.68× *2RS* **2**

2 Metatibial spurs white; scutellum (Figs 4) with apex truncate and scutellar disc length < 0.85× that of mesoscutum; notauli less impressed; forewing with length of vein r 3.30× that of *3RSa*; mediotergite 2 (Fig. 14) less transverse, its medial length 0.77× its width at apex (Kenya) ..... ***Philoplitis masneri* sp. n.**

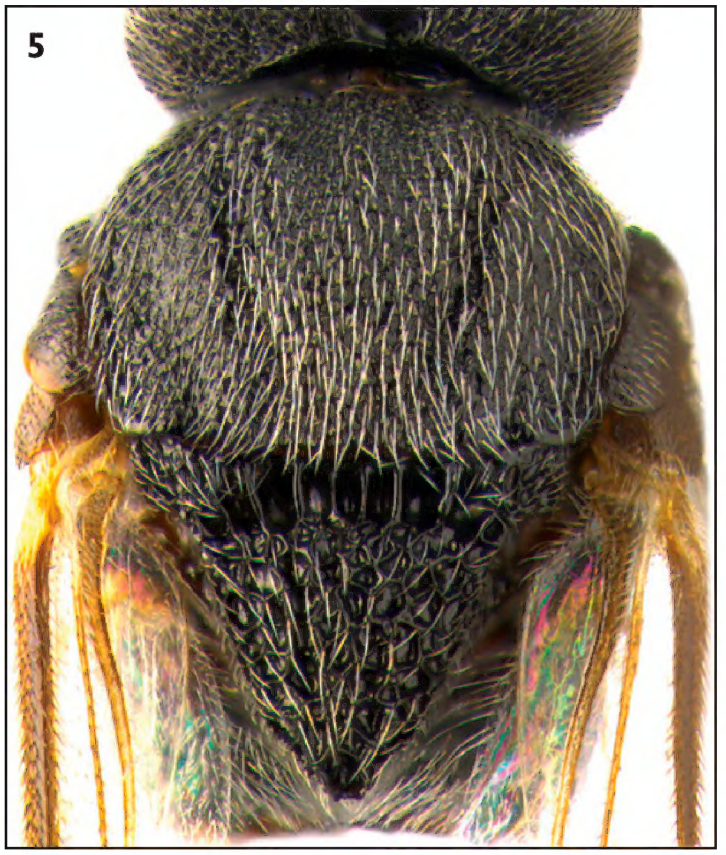
– Metatibial spurs yellow or yellowish-brown; scutellum (Figs 3, 6) longer and not truncate, scutellar disc length > 0.90× that of mesoscutum, usually close to same size; notauli deeply impressed; forewing with length of vein r < 2.60× *3RSa*; mediotergite 2 (Figs 13, 16) more transverse, its medial length less than 0.45× its width at apex..... **3**

3 Mediotergite 2 dark brown, transversely striate medially and longitudinally striate lateroapically (Fig. 16); tergite 1 length less than 1.80× its apical width (Sri Lanka and southern India) ..... ***Philoplitis striatus* sp. n.**

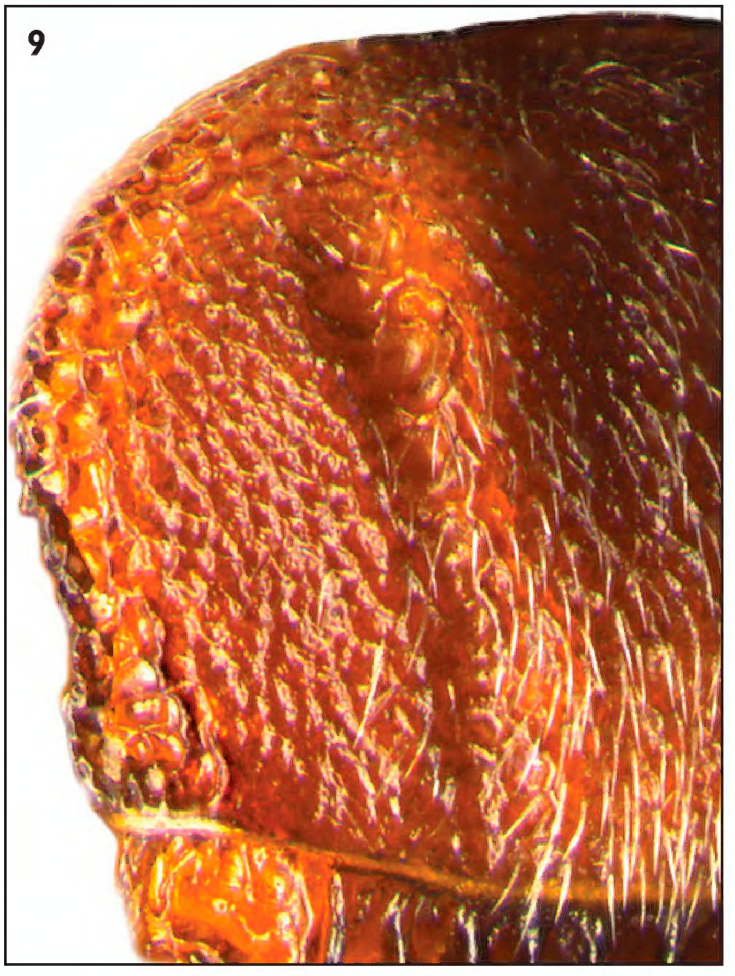
– Mediotergite 2 yellowish-white, at least basally, and almost completely smooth; tergite 1 length twice or more its apical width **4**

4 Body color black; palpi brown; mediotergite 1 length 2.0× its apical width; mediotergite 2 with medial length 0.50× its width at apex and with median zone outlined by rounded groove widening toward apex of tergite (Northern India)..... ***Philoplitis adustipalpus* Ahmad, 2005**

– Body color reddish-brown; palpi light brown with apical segments yellowish; mediotergite 1 length > 2.0× its apical width; mediotergite 2 (Fig. 13) with medial length less than 0.45× its width at apex and with median zone outlined by shallow and quite divergent groove (Philippines and southeastern China) ..... ***Philoplitis coniferens* Nixon, 1965**



Figures 3–6. 3 Dorsal view of mesoscutum and scutellum *Philoplitis coniferens* **4** Dorsal view of mesoscutum and scutellum *Philoplitis masneri* **5** Dorsal view of mesoscutum and scutellum *Philoplitis punctatus* **6** Dorsal view of mesoscutum and scutellum *Philoplits striatus*.



Figures 7-9. 7 Dorsolateral view of *Philoplitis masneri* mesoscutum showing sculture details **8** Dorsolateral view of *Philoplitis punctatus* mesoscutum showing sculture details **9** Dorsolateral view of *Philoplitis striatus* mesoscutum showing sculture details.

***Philoplitis adustipalpus* Ahmad, 2005**: 1736.

Holotype: ♀, INDIA (Zoology Department, Aligarh Muslim University). Not examined.

Diagnosis. This species is the only known one with palpi completely brown, and it also has the shortest metatibial spurs, the inner one being 0.45× the length of the basitarsus (> 0.50 in all other species). It is separated from *P. coniferens* by the combination of black color and shorter length/width ratio of mediotergite 1; from *P. striatus* by its smooth mediotergite 2, much shorter tergum 3 and shorter inner metatibial spur (compared to length of both basitarsus and outer spur); from *P. masneri* by the color of mediotergite 2 and its length/apical width ratio; and from *P. punctatus* by the length of inner metatibial spur and shape of mediotergite 2.

Comments. This is the only species for which we were not able to study specimens. It was described from two females collected in northern India (Uttar Pradesh). Based on the description and three figures provided by the authors (Ahmad et al., 2005) it is clearly separated from the closer species geographically (*P. striatus*, from southern India) as well from as the rest of the species within the genus.

***Philoplitis coniferens* Nixon, 1965**: 267.

Holotype: ♀, PHILIPPINES (USNM). Examined.

Diagnosis. This species has the longest scutellar disc and first mediotergite of all known *Philoplitis*. It also has the shortest metatibial spurs and the thinnest metafemur. Its reddish-brown color pattern distinguishes it from *P. adustipalpus*, *P. masneri* and *P. punctatus* (all of them are mainly black), and its second mediotergite yellow basally and virtually smooth distinguishes it from *P. striatus* (with completely brown and striate mediotergite 2).

Description. Head densely rugosopunctate, frons transversely striate, small and impressed area (behind posterior ocelli and reaching to central part of occiput) smooth. Antenna long, length of 2nd flagellomere 2.30× its width, length of 15th flagellomere 2.70× its width. Mesosoma with rather dense and long pubescence. Mesoscutum with coarse punctures, notauli deeply impressed and with impressed surface posterolaterally above tegula (Fig. 3). Scutellum coarsely punctate, in lateral view with apex pointing ventrally, scutellar disc length/width ratio 1.24× (1.24–1.25), and its length 0.97× (0.92–1.00) that of mesoscutum. Mesopleuron mostly punctate, with median smooth area below speculum and some striation marking sternaulus; metapleuron punctate. Propodeum rugose and with complete median longitudinal carina. Forewing ratios: *r/3Rsa*: 1.33 (1.33); *r/r-m*: 1.80 (1.60–2.00); *r/2RS*: 0.68 (0.62–0.73); *3RS/2M*: 0.61 (0.54–067); *2RS/2M*: 1.08 (1.00–1.17); *r-m/2M*: 0.39 (0.36–0.42); *r*/(*r-2M*): 0.41 (0.40–0.42); height of 2nd submarginal cell/(*r-2M*): 0.46 (0.42–0.50). Tarsal claws with 2–3 teeth and with arolium slightly longer than claw length; metafemur thin, its length 3.47× (3.42–3.64) its maximum width; inner spur of metatibia 0.51× (0.44–

0.61) length of first tarsomere. Metasoma with apical half of mediotergite 1 sculptured, its length 2.20× (2.10–2.30) its width at apex; mediotergite 2 smooth, its medial length 0.42× (0.35–0.45) its width at apex and with median zone outlined by shallow and quite divergent groove (Fig. 13); tergum 3+ smooth.

Color. Body reddish-brown; palpi light brown with apical 3–5 maxillary palps yellowish-white; scape, mandible, tibia and tarsi of first two pairs of legs, apex of mediotergite 1, mediotergite 2 fully, and sterna 1–3, orange-yellow; rest of antenna light brown; hind legs dark brown; metatibial spurs orange-yellow. Wing veins and stigma light brown (*Rs+M* hyaline), with brownish cloud beneath stigma that extends to *2M*.

Material examined. Holotype ♀ (USNM, type 69356). PHILIPPINES: Los Baños. Paratypes, 2 ♂ (USNM). PHILIPPINES: Los Baños, Baker; Dapitan, Mindañao, Baker.

Comments. This species has been recorded in the Philippines and southeastern China (Nixon 1965; Mason 1981; He 1983; You et al. 1990). The updated description provided here is based on observations of the holotype and two paratypes.

Philoplitis masneri sp. n.

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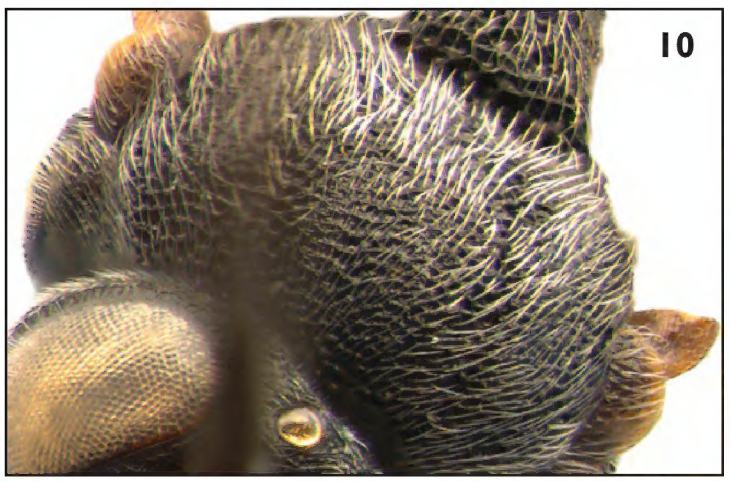
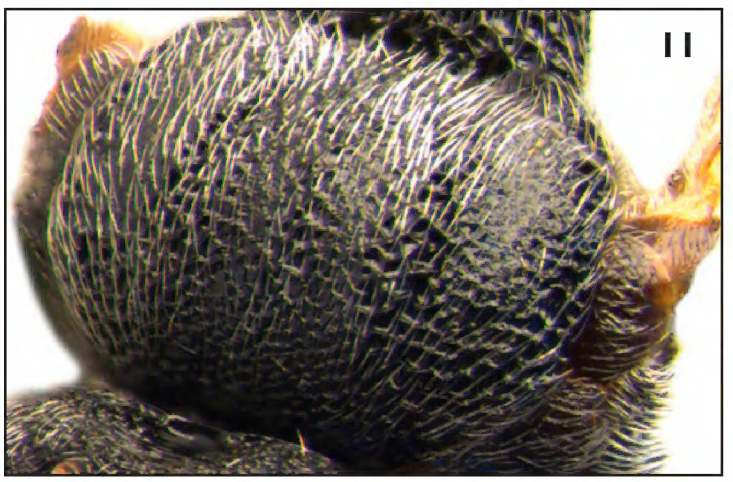
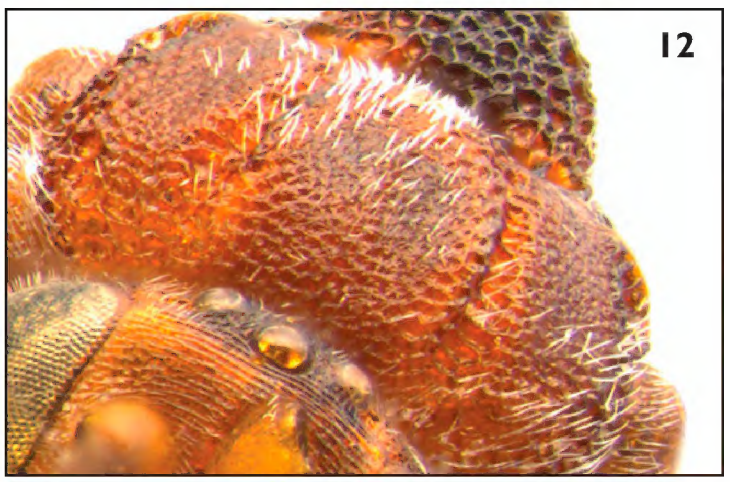
Diagnosis. The white color of the second mediotergite as well as of the metatibial spurs distinguishes it from all other species of *Philoplitis*. Also, this species has the shallowest notauli, the thickest metafemur, the longest *r* vein (compared to those forming the 2nd submarginal cell) and the narrowest mediotergite 2 within the genus.

Description. Head densely rugosopunctate, frons transversely striated, small and impressed area (just behind posterior ocelli and extending to central part of occiput) smooth. Antenna long, length of 2nd flagellomere 2.4× its width, length of 15th flagellomere 2.7× its width. Mesosoma with rather dense and long pubescence. Mesoscutum punctate, without impressed surface posterolaterally, and notauli scarcely impressed and not outlined by coarse punctures (Fig. 4, 7 and 10). Scutellum coarsely punctate and with apex truncate, its length/width ratio 1.06×, and scutellar disc length 0.83× that of mesoscutum. Mesopleuron punctate except medial smooth area below the speculum and very fine striation marking the sternaulus. Propodeum rugose and with complete median longitudinal carina. Forewing ratios: *r/3RSa*: 3.30; *r/r-m*: 2.50; *r/2RS:* 1.00; *3RS/2M*: 0.33; *2RS/2M*: 1.11; *r-m/2M*: 0.44; *r*/(*r-2M*): 0.40; height of 2nd submarginal cell/(*r-2M*): 0.44. Tarsal claws with 3 teeth and with arolium enlarged, about twice as long as claw length; metafemur thick, its length 2.95× its maximum width; inner spur of metatibia 0.57× length of first tarsomere. Metasoma with apical half of mediotergite 1 finely sculptured, with smooth triangular area apically, its length 2.12× its width at apex; mediotergite 2 completely smooth, with medial zone outlined by sharp but hardly divergent carinae on each side, its median length 0.77 its width at apex (Fig. 14); tergum 3+ smooth.

Color. Head black with clypeus dark brown, mandibles yellowish-white and palpi brown with apical 3–5 maxillary palps white. Scape and pedicel light brown, rest of







Figures 10-12. 10 Dorsofrontal view of *Philoplitis masneri* mesoscutum showing sculture details **11** Dorsofrontal view of *Philoplitis punctatus* mesoscutum showing sculture details **12** Dorsofrontal view of *Philoplitis striatus* mesoscutum showing sculture details.

antenna brown. Mesosoma black with silver pubescence, tegula brown. First two pair of legs with coxa, trochanter and femur brown, tibiae and tarsi yellow (brown basally in mesotibia); hind legs completely brown (dark brown to almost black on metafemur and metatibia); tibial spurs whitish-yellow. Wing veins and stigma brown (*Rs+M* hyaline), with a brownish cloud beneath stigma that extends to *2M*. Metasoma brown (darker in mediotergite 1, lighter in tergum 3+); mediotergite 2 completely, apical smooth area of mediotergite 1, laterotergites 1–2, and sterna 1–3, yellowish-white.

Etymology. We dedicate this species to our friend and colleague Lubomír Masner, an extraordinary example of a dedicated and passionate entomologist. He not only found the only known specimens of this species and *P. punctatus* when sorting different samples, but also encouraged us to study the genus.

Material examined. Holoytpe ♂ (CNC type 23528). KENYA: Nyanza Ungoye, down 1147 m; 0°36.91'S 34°05.52'E; 5–19.V.2006, Malaise Trap, R. Copeland.

Comments. This is the first recorded species of *Philoplitis* from the Afrotropical region.

***Philoplitis punctatus* sp. n.**

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Diagnosis. The black coloration of *P. punctatus* distinguishes it from *P. striatus* and *P. coniferens*; the transverse mediotergite 2 separates it from *P. masneri* (with a broader mediotergite 2); and the length of inner metatibial spur and shape of mediotergite 2

distinguishes this species from *P. adustipalpus*. It also has the shortest scutellar disc and the most coarsely sculptured mesoscutum within the genus.

Description. Head densely rugosopunctate, frons transversely striated, small and impressed area behind posterior ocelli (and reaching to the central part of the occiput) rather smooth but with some striation. Antenna long, length of 2nd flagellomere 2.7× its width, length of 15th flagellomere 3.0× its width. Mesosoma with rather dense and long pubescence. Mesoscutum with coarse punctures medially and along anterior and lateral margins (the last one above tegulae), and notauli deeply impressed with coarse punctures (Fig. 5, 8 and 11). Scutellum coarsely punctate, relatively short (length/width ratio 0.92×), scutellar disc length 0.77× that of mesoscutum, in lateral view with apex toward dorsal surface. Mesopleura mostly punctate, with median smooth area below speculum and some striation marking the sternaulus; metapleuron punctate. Propodeum rugose and with complete median longitudinal carina. Forewing ratios: *r/3RSa*: 1.00; *r/r-m*: 1.00; *r/2RS*: 0.50; *3RS/2M*: 0.60; *2RS/2M*: 1.20; *r-m/2M*: 0.60; *r*/(*r-2M*): 0.35; height of 2nd submarginal cell/(*r-2M*): 0.50. Tarsal claws with 3 teeth and with arolium enlarged, about twice as long as claw length; metafemur thick, its length 3.08× its maximum width; inner spur of metatibia 0.58× the length of first tarsomere. Metasoma with apical half of mediotergite 1 finely sculptured, its length 2.00× its width at apex; mediotergite 2 smooth (except for three transverse striae centrally), with medial zone outlined by sharp convexities, its medial length 0.46 its width at apex (Fig. 15); tergum 3+ smooth.

Color. Head black with clypeus brown, mandibles yellowish and palpi dark brown with apical 4–5 maxillary palps light brown. Scape and pedicel yellowish-brown, rest of antenna dark brown. Mesosoma black with silver pubescence, tegula dark brown. Legs brown (the first pair lighter, the third pair dark brown, almost black), protibiae and protarsi yellow (except the last tarsomere which is dark brown); metatibial spurs dark brown. Wing veins and stigma brown (*Rs+M* hyaline), with a brownish cloud beneath stigma that extends to *2M*. Metasoma mostly dark brown; except for sterna 1–3, apical strip on mediotergite 1, and basal strip on mediotergite 2, which are yellowish-white; mediotergite 2 otherwise light brown.

Etymology. The name alludes to the distinctive, coarse punctures medially, anteriorly and laterally on the mesoscutum.

Material examined. Holoytpe ♂ (CNC type 23529). THAILAND: Khankaen Prov., Phu Pha Man Natl. Pk, 48Q 018044, 350 m, UTM 7854124, 24–31.VII.2005.

***Philoplitis striatus* sp. n.**

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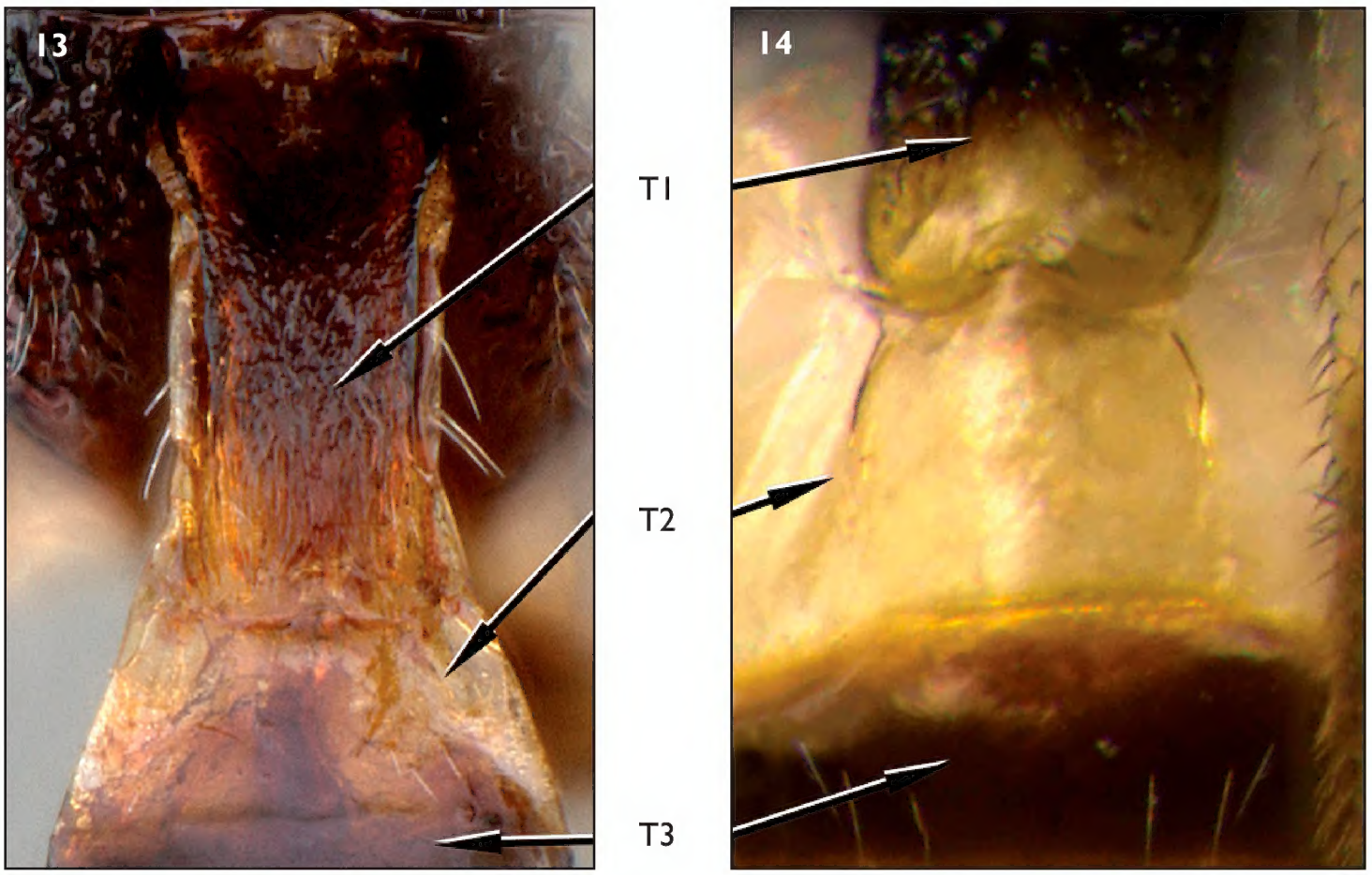
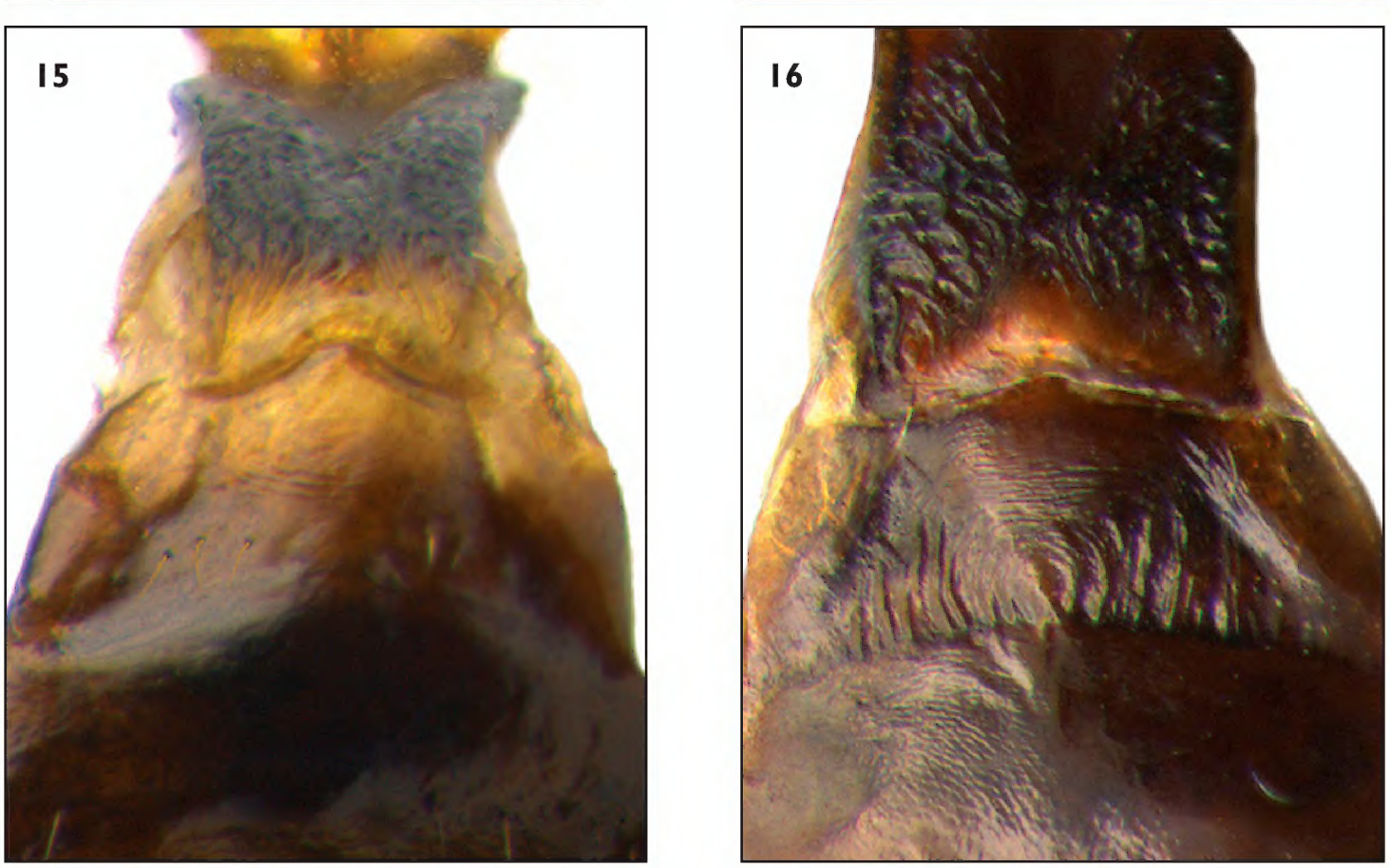
Philoplitis sp. Mason, 1981: 130.

Diagnosis. The striate mediotergite 2 distinguishes this species from all the others. Additionally, the reddish-orange body color separates it from *P. adustipalpus*, *P. masneri* and *P. punctatus*; while the shorter length/width ratio of mediotergite 2 distinguishes it from *P. coniferens*.

Description. Head densely rugosopunctate, frons transversely striated, small and impressed area (behind posterior ocelli and reaching to central part of the occiput) rather smooth but with confluent fine punctures. Antenna long, length of 2nd flagellomere 2.3× its width, length of 15th flagellomere 2.8× its width. Mesosoma with





Figures 13-16. 13 First metasomal segments of *Philoplitis coniferens* **14** First metasomal segments of *Philoplitis masneri* **15** First metasomal segments of *Philoplitis punctatus* **16** First metasomal segments of *Philoplits striatus.*

rather dense and long pubescence. Mesoscutum with coarse punctures, notauli deeply impressed, and with impressed surface posterlaterally above the tegulae (Fig. 6, 9, 12). Scutellum coarsely punctate, in lateral view with apex pointing upwards, scutellar disc length/width ratio 1.10× (0.97–1.20), and its length 0.94× (0.90–1.00) that of mesoscutum. Mesopleura mostly punctate, with medial smooth area below speculum and some striation marking the sternaulus; metapleuron punctate. Propodeum rugose and with complete median longitudinal carina. Forewing ratios: *r/3RSa*: 2.05 (1.65–2.60); *r/r-m*: 2.33 (2.10–2.67); *r/2RS*: 0.95 (0.90–1.00); *3RS/2M*: 0.50 (0.45–0.57); *2RS/2M*: 1.14 (1.00–1.30); *r-m/2M*: 0.45 (0.36–0.57); *r*/(*r-2M*); 0.47 (0.44–0.50); height of 2nd submarginal cell/(*r-2M*): 0.41 (0.35–0.47). Tarsal claws with 2–3 teeth and with arolium subequal to claw length; metafemur length 3.15× (3.10–3.20) its maximum width; inner spur of metatibia 0.55× (0.50–0.60) the length of first tarsomere. Metasoma with apical half of mediotergite 1 sculptured, its length 1.74× (1.70–1.80) its width at apex; mediotergite 2 broad, with medial zone outlined by shallow convergent grooves that form a transverse striated triangle, with carinae markedly divergent, mediotergite with longitudinal striation apically and its medial length 0.38× (0.30–0.41) its width at apex (Fig. 16); tergum 3+ smooth.

Color. Head (including antenna) and mesosoma reddish-orange; palpi brown with apical 3–5 maxillary palps light brown; occiput sometimes with darker marks, as well as base of scutellum, mesosternum, metapleura and propodeum. Legs orange-brown; tibia and tarsi of first two pairs yellowish-white; hind legs dark brown; metatibial spurs orange-yellow. Wing veins and stigma light brown (*Rs+M* hyaline), with a brownish cloud beneath stigma that extends to *2M*. Metasoma reddish-brown; with sternites 1–3 yellowish-white, and mediotergite 1 with basal third and a small apical triangular area orange.

Variation. One male has a different color pattern (all palpi yellowish; body color blackish), and the striation in mediotergite 2 is not clear. Lacking more specimens for study we tentatively consider this specimen as *P. striatus* but exclude it from the type series.

Etymology. The name alludes to the distinctive striation on mediotergite 2.

Material examined. Holotype ♂ (CNC type 23530). INDIA: Madras State, Coimbatore, 1400 ft, VIII.1959, P. S. Nathan (SEM photo No. 23–79; H.R.M.M.). Paratypes 1♀ and 1♂ (USNM). SRI LANKA: Amp. Dist., Inginiyagala, 250 ft, Samudra Gardens, malaise trap, 22–23.XI.1976, Hevel, Dietz, Karunaratne and Balasooriya colls.; Tri. Dist., Trincomalee, China Bay Ridge Bungalow, 0–100 ft, 13–17.V.1976, Krombein, P., S. Karunaratne and Balasooriya. Other material examined: SRI LANKA: Mate Dist. Kibissa, 0.5 mi West of Sigiriya, jungle, malaise trap, 28.VI–4.VI.1978 (USNM 1♂), Krombein, Karunaratne, Wijesinhe and Kulasekare.

Discussion

Philoplitis now comprises five species widely distributed across the Oriental and Afrotropical regions. Though species of *Philoplitis* are rare or at least difficult to

collect, the distribution of the genus is much wider than previously known, covering two continents, and further collecting will undoubtedly reveal even more species. Most of the specimens have been collected with Malaise traps, and so far they have been found from sea level to 1150 m, often in rainforest habitats. Host records remain elusive.

Mason (1981) considered the structure of the pronotum, scutellum, metanotum and color of the palpi to be especially strong synapomorphies for *Philoplitis*. Whitfield et al. (2002) discussed the relationships of this genus based on a matrix of coded morphological characters used in their phylogenetic analysis of Microgastrinae. Our study allowed us to verify and/or clarify some of those character states (present in all *Philoplitis* species known so far). We provide below some comments that may help to elucidate the phylogenetic position of *Philoplitis*.

The lower outer corner of propleuron with an upwardly projecting flange (character # 5 sensu Whitfield et al. 2002) is found only in three other genera of Microgastrinae: *Fornicia*, *Hypomicrogaster* and *Wilkinsonellus*. The number of lateral pronotal grooves (character # 4) present in *Philoplitis* is two (dorsal and ventral), as stated by Mason (1981); however this character was assigned by Whitfield et al. (2002) as one pronotal groove.

The scutellum is unique in *Philoplitis* not only because of its enormous length compared to all other microgastrines (Figs 3–6) but also its sculpture is coarse and deep throughout (Nixon 1965). The sculpture is developed on the medioposterior band of the scutellum in 10 other genera: *Alloplitis, Buluka, Diolcogaster, Exis, Fornicia, Illidops, Microplitis, Protomicroplitis, Snellenius*, and *Wilkinsonellus* (Whitfield et al. 2002), but none of them has such extensive and deep reticulation. Introducing a new character state that defines more precisely the sculpture pattern of the scutellum is advisable.

The anterior margin of metanotum withdrawn from scutellum (character # 10) and bearing long, apically cylindrical setose process (character # 9) was thought to be unique to *Philoplitis* and *Alloplitis* only (Mason 1981). However, from the matrix of coded characters in Whitfield et al. (2002) similar conditions are shared with another seven genera (*Clarkinella, Deuterixys, Dolichogenidea, Iconella, Pholetesor, Promicrogaster* and *Protapanteles*). Some refinement to the codification of this character state is advisable.

The size of the metacoxa (character # 15) in *Philoplitis* (Fig. 1) is intermediate between what Whitfield et al. (2002) scored as normal or enlarged, which could lead to assigning it a different character state than previously.

The modification and/or incorporation of all character states here mentioned to the Whitfield et al. (2002) data matrix will be dealt with in a future paper with a broader focus than just *Philoplitis*.

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